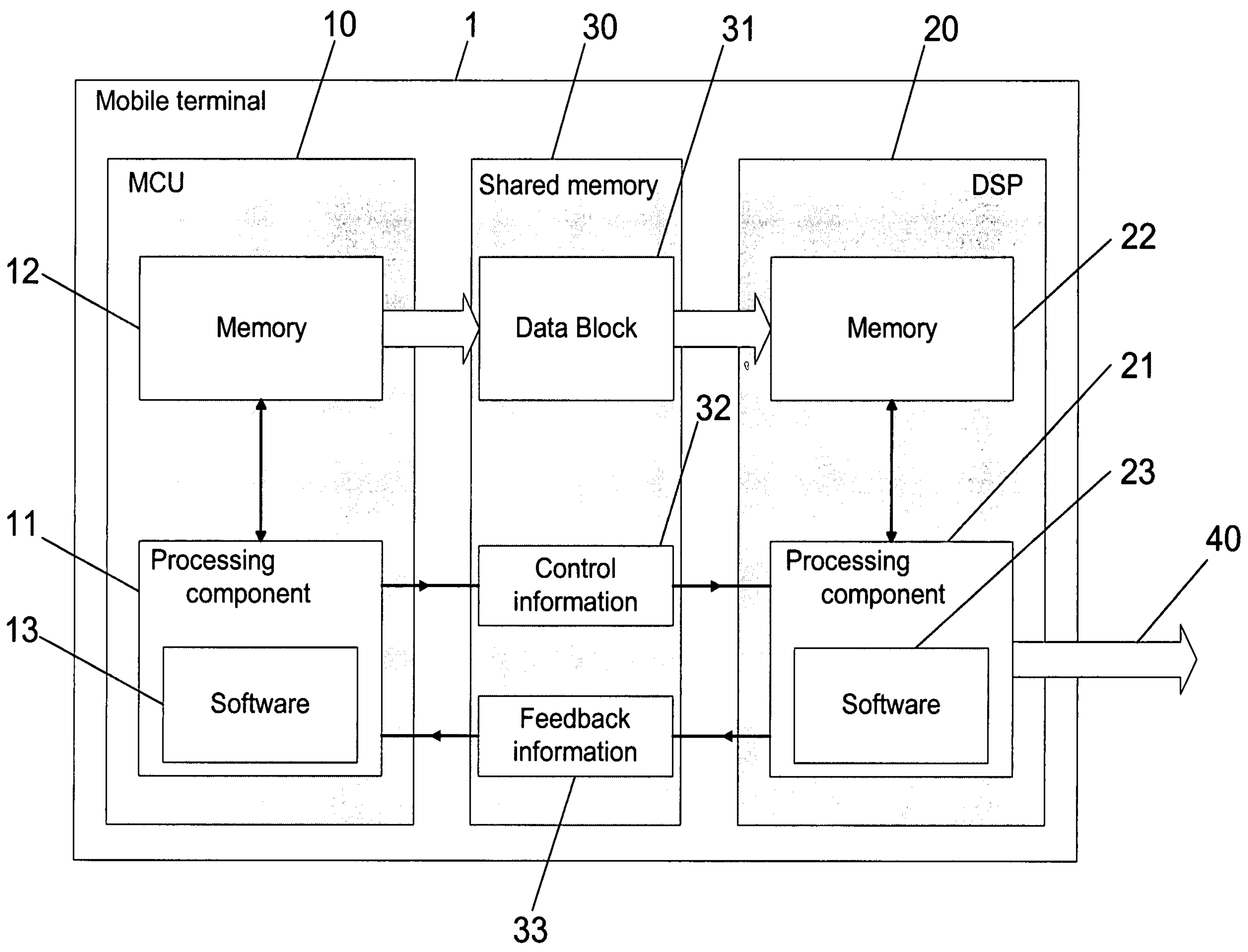
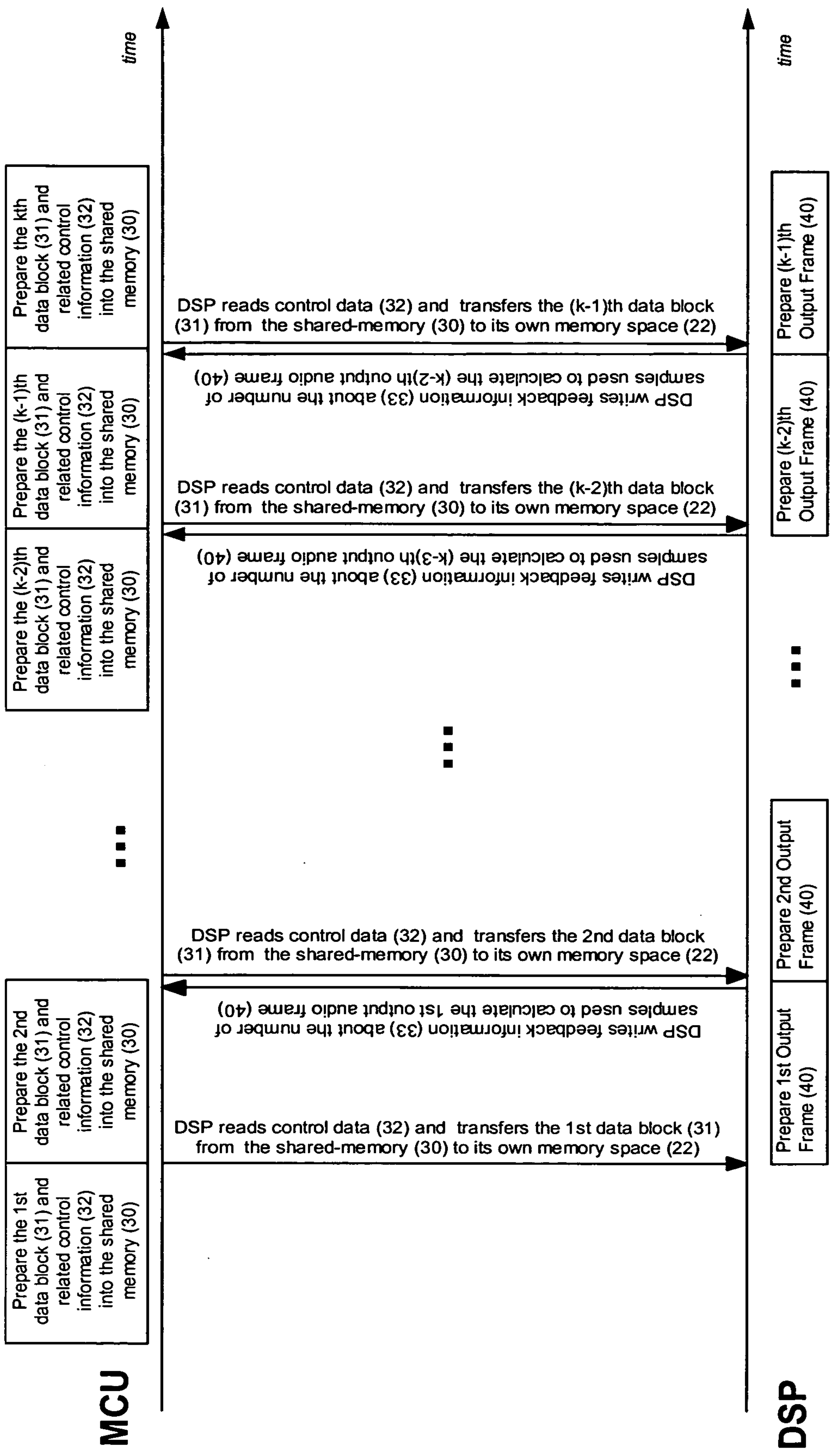

10
1
30
31
20
Mobile terminal
MCU
Shared memory
DSP
12
Memory
Data Block
Memory
22
21
32
23
11
Processing component
Control information
Processing component
40
13
Software
Feedback information
Software
33

Fig. 1



MCU
DSP
time
time
Prepare the 1st data block (31) and related control information (32) into the shared memory (30)
Prepare the 2nd data block (31) and related control information (32) into the shared memory (30)
Prepare the (k-2)th data block (31) and related control information (32) into the shared memory (30)
Prepare the (k-1)th data block (31) and related control information (32) into the shared memory (30)
Prepare the kth data block (31) and related control information (32) into the shared memory (30)
DSP reads control data (32) and transfers the 1st data block (31) from the shared-memory (30) to its own memory space (22)
DSP writes feedback information (33) about the number of samples used to calculate the 1st output audio frame (40)
DSP reads control data (32) and transfers the 2nd data block (31) from the shared-memory (30) to its own memory space (22)
DSP writes feedback information (33) about the number of samples used to calculate the (k-3)th output audio frame (40)
DSP reads control data (32) and transfers the (k-2)th data block (31) from the shared-memory (30) to its own memory space (22)
DSP writes feedback information (33) about the number of samples used to calculate the (k-2)th output audio frame (40)
DSP reads control data (32) and transfers the (k-1)th data block (31) from the shared-memory (30) to its own memory space (22)
Prepare 1st Output Frame (40)
Prepare 2nd Output Frame (40)
Prepare (k-2)th Output Frame (40)
Prepare (k-1)th Output Frame (40)

Fig. 2

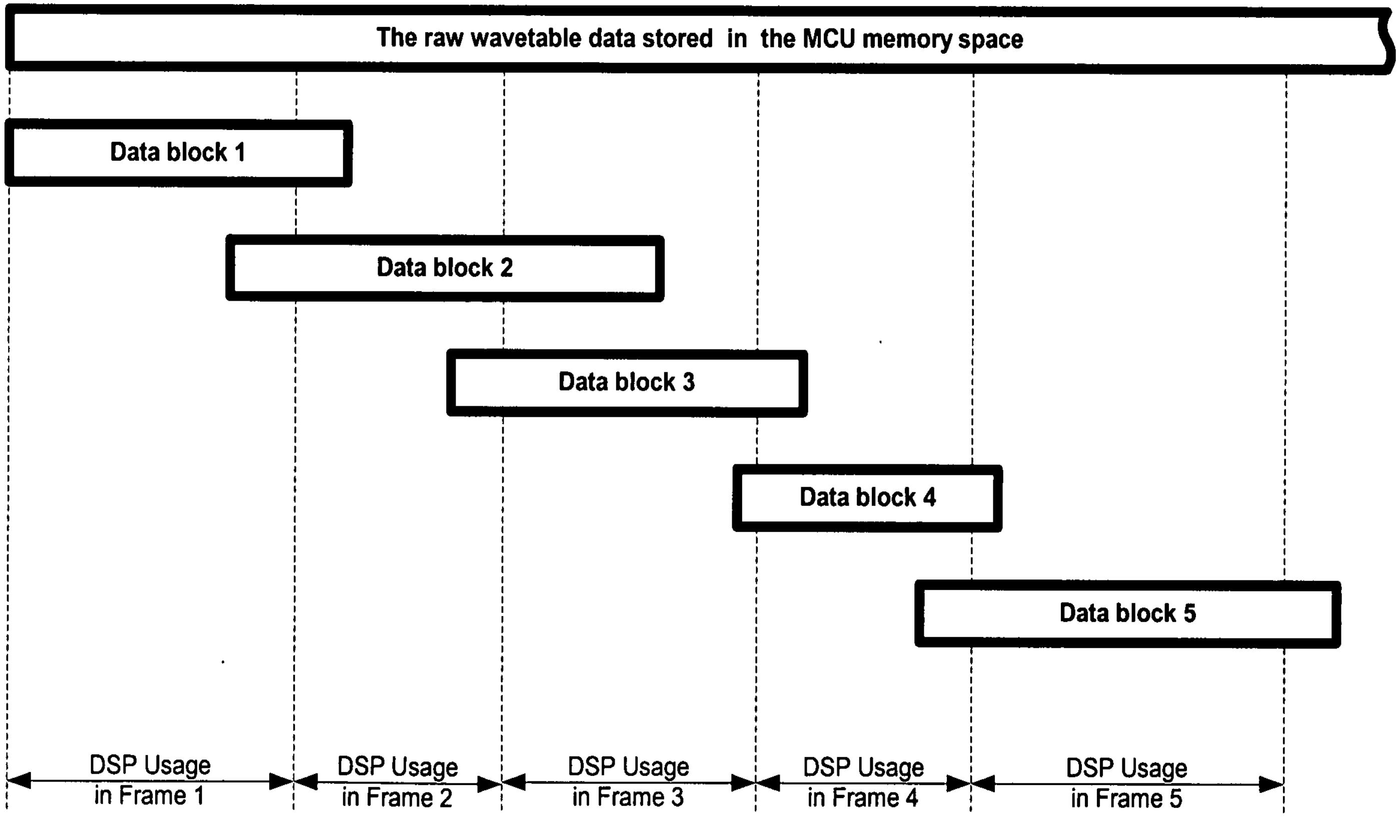

The raw wavetable data stored in the MCU memory space
Data block 1
Data block 2
Data block 3
Data block 4
Data block 5
DSP Usage in Frame 1
DSP Usage in Frame 2
DSP Usage in Frame 3
DSP Usage in Frame 4
DSP Usage in Frame 5

Fig. 3

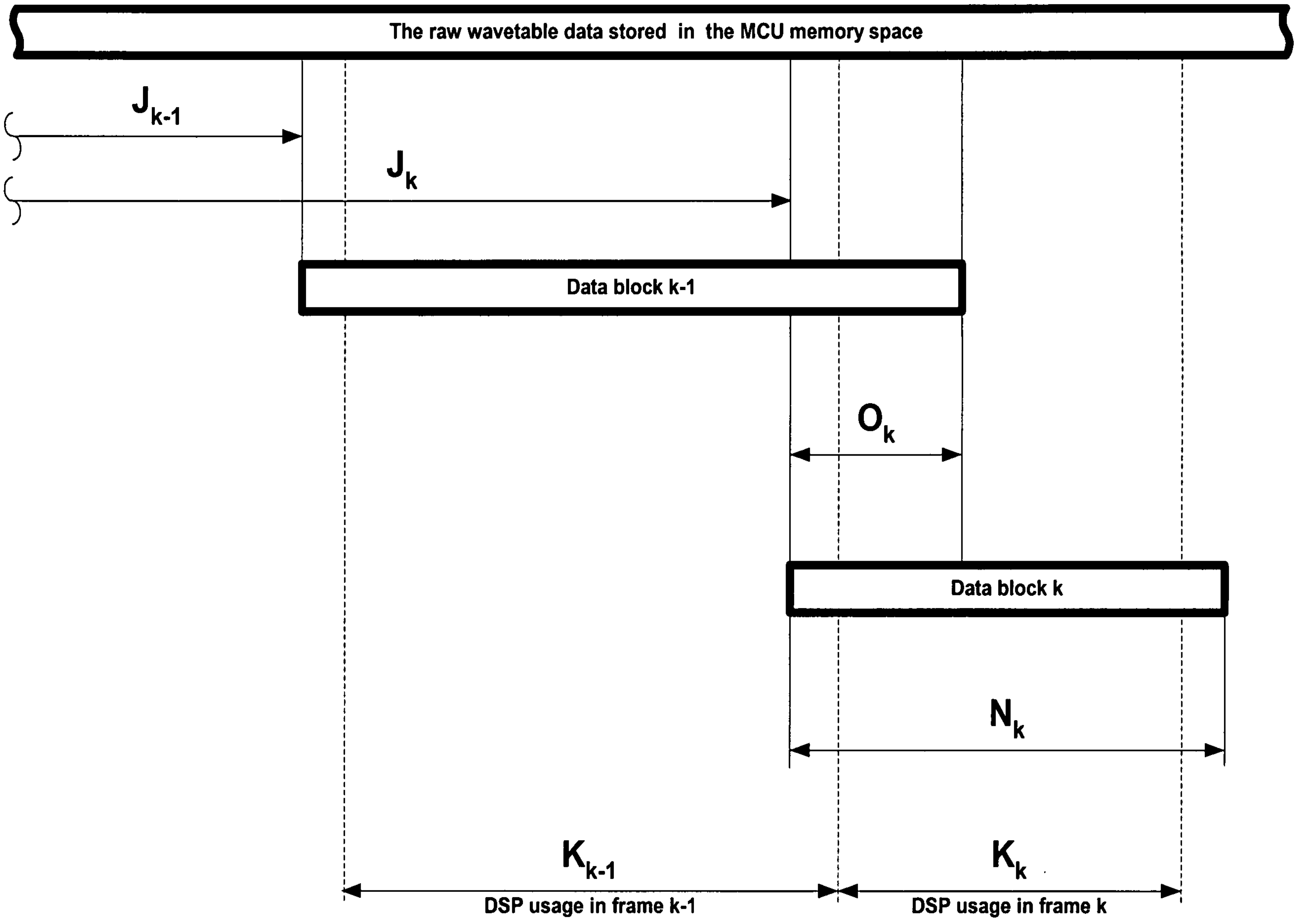

The raw wavetable data stored in the MCU memory space
J_{k-1}
J_k
Data block k-1
O_k
Data block k
N_k
K_{k-1}
DSP usage in frame k-1
K_k
DSP usage in frame k

Fig. 4

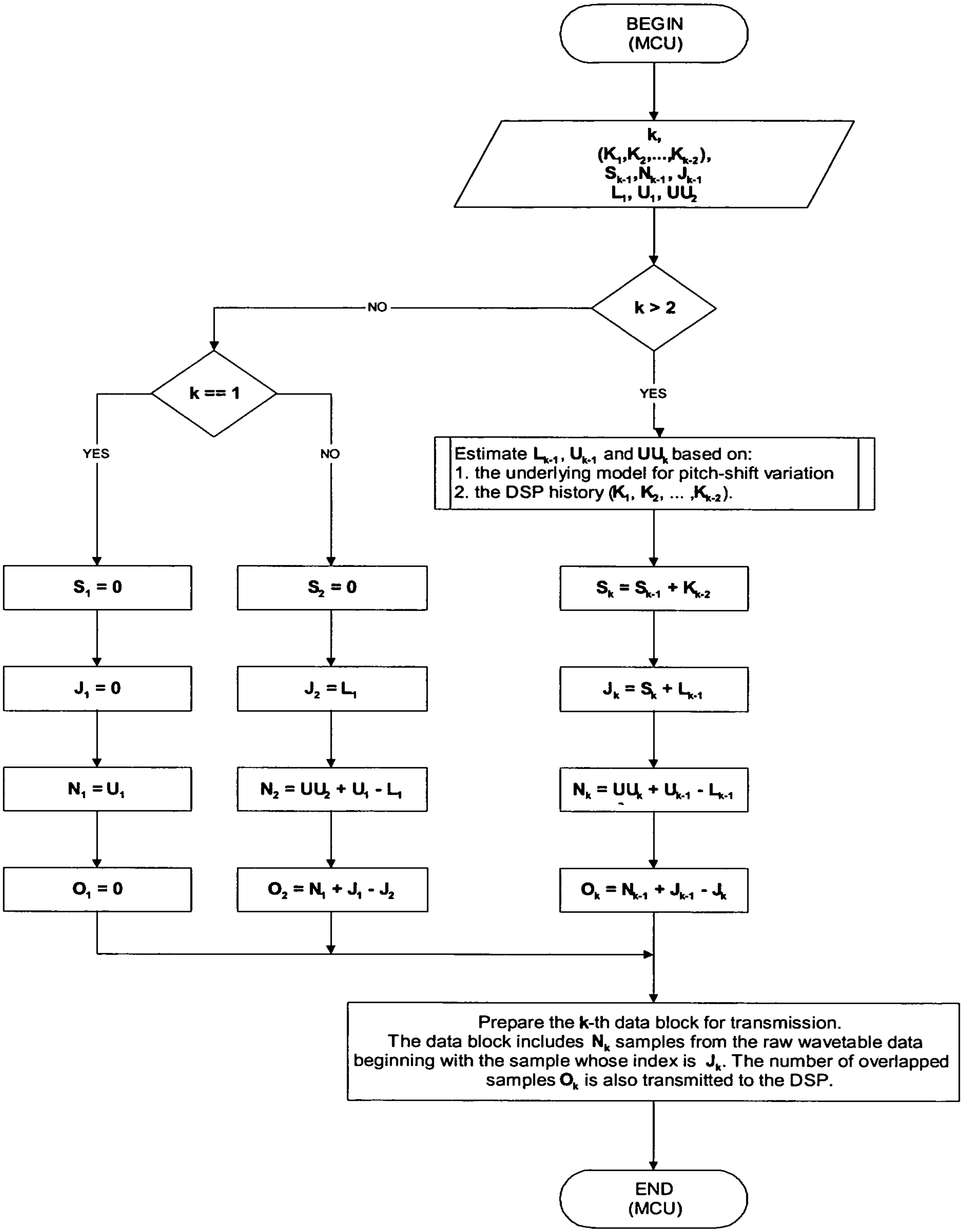

BEGIN (MCU)
k,
$(K_1, K_2, \ldots, K_{k-2})$,
$S_{k-1}, N_{k-1}, J_{k-1}$
L_1, U_1, UU_2
$k > 2$
NO
YES
$k == 1$
YES
NO
Estimate L_{k-1}, U_{k-1} and UU_k based on:
1. the underlying model for pitch-shift variation
2. the DSP history $(K_1, K_2, \ldots, K_{k-2})$.
$S_1 = 0$
$J_1 = 0$
$N_1 = U_1$
$O_1 = 0$
$S_2 = 0$
$J_2 = L_1$
$N_2 = UU_2 + U_1 - L_1$
$O_2 = N_1 + J_1 - J_2$
$S_k = S_{k-1} + K_{k-2}$
$J_k = S_k + L_{k-1}$
$N_k = UU_k + U_{k-1} - L_{k-1}$
$O_k = N_{k-1} + J_{k-1} - J_k$
Prepare the k-th data block for transmission.
The data block includes N_k samples from the raw wavetable data beginning with the sample whose index is J_k. The number of overlapped samples O_k is also transmitted to the DSP.
END (MCU)

Fig. 5

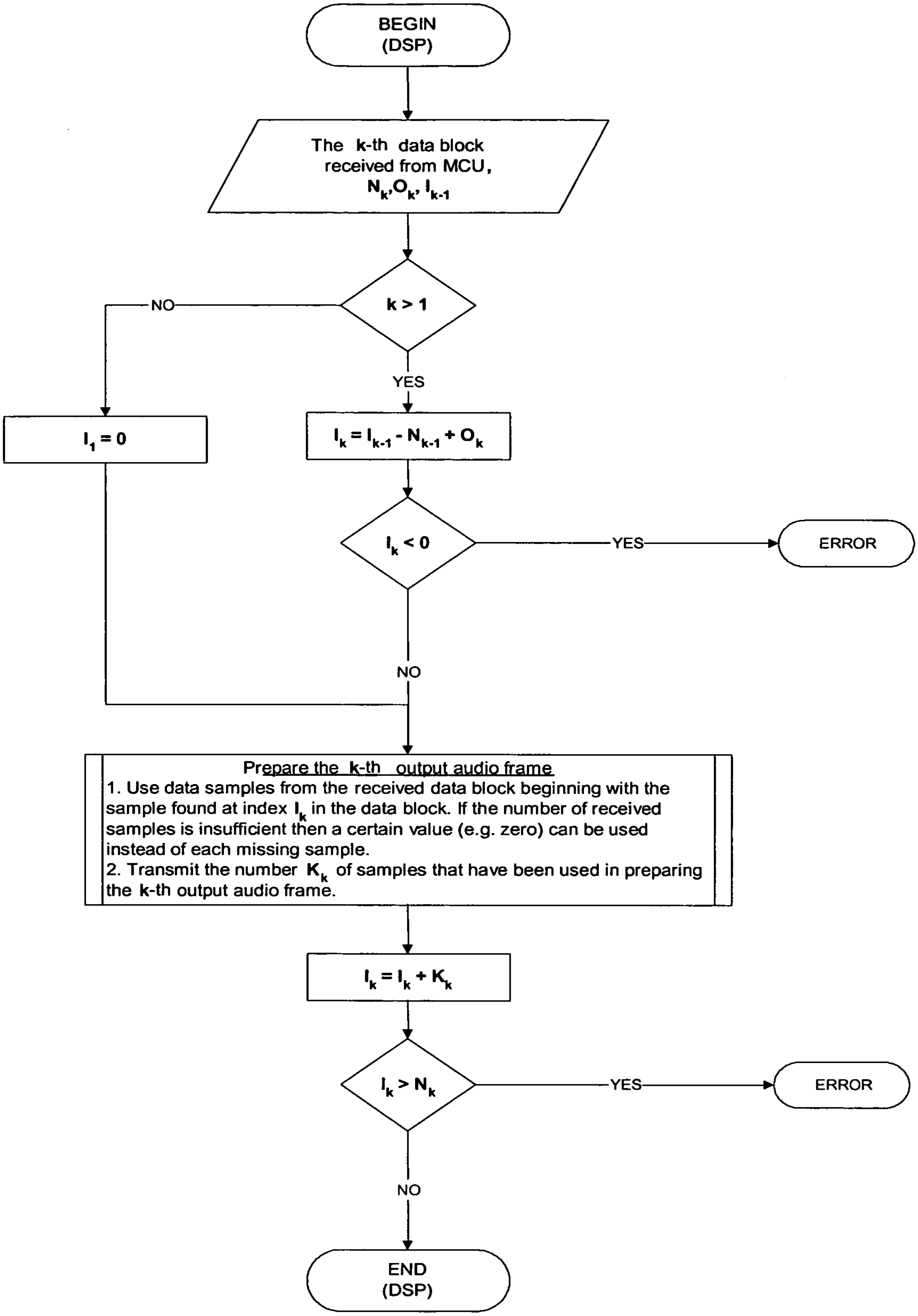

BEGIN (DSP)
The k-th data block received from MCU, N_k, O_k, I_{k-1}
$k > 1$
NO
YES
$I_1 = 0$
$I_k = I_{k-1} - N_{k-1} + O_k$
$I_k < 0$
YES
ERROR
NO
Prepare the k-th output audio frame
1. Use data samples from the received data block beginning with the sample found at index I_k in the data block. If the number of received samples is insufficient then a certain value (e.g. zero) can be used instead of each missing sample.
2. Transmit the number K_k of samples that have been used in preparing the k-th output audio frame.
$I_k = I_k + K_k$
$I_k > N_k$
YES
ERROR
NO
END (DSP)

Fig. 6

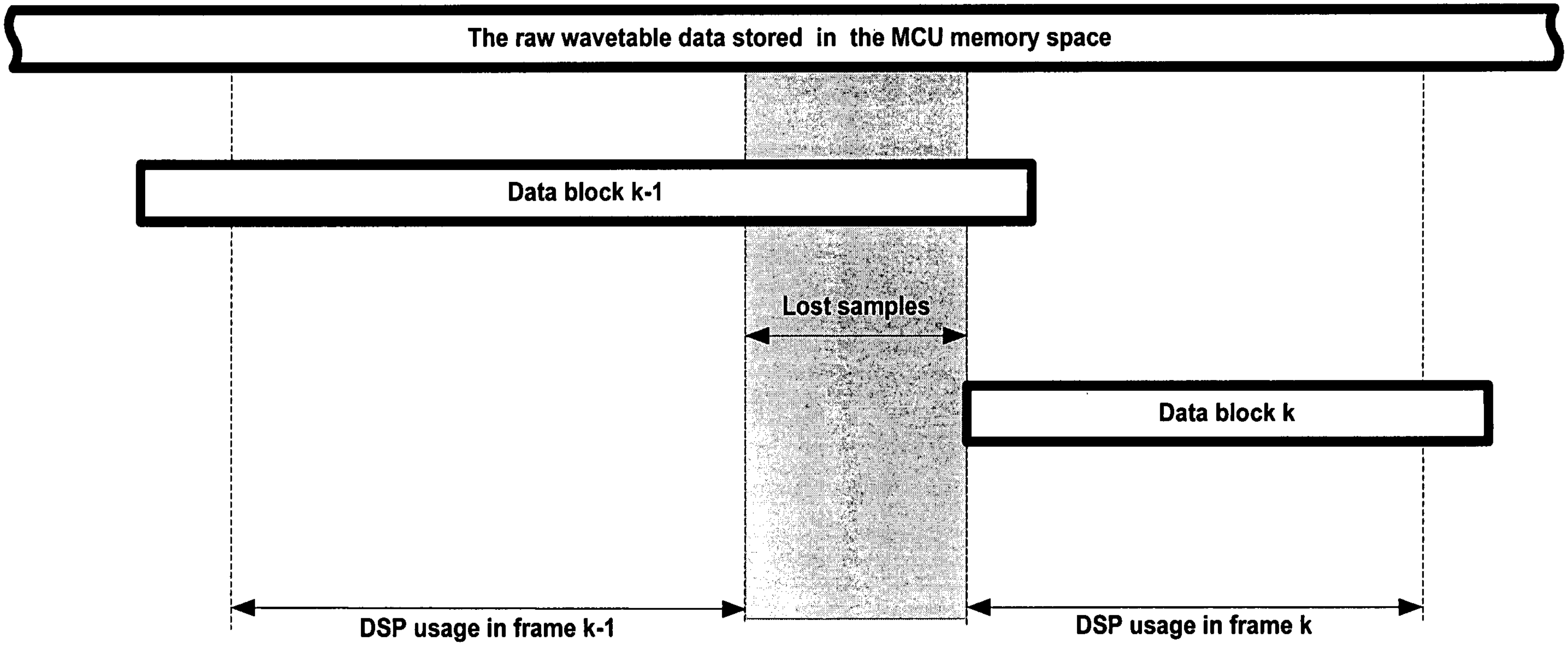

The raw wavetable data stored in the MCU memory space
Data block k-1
Lost samples
Data block k
DSP usage in frame k-1
DSP usage in frame k

Fig. 7

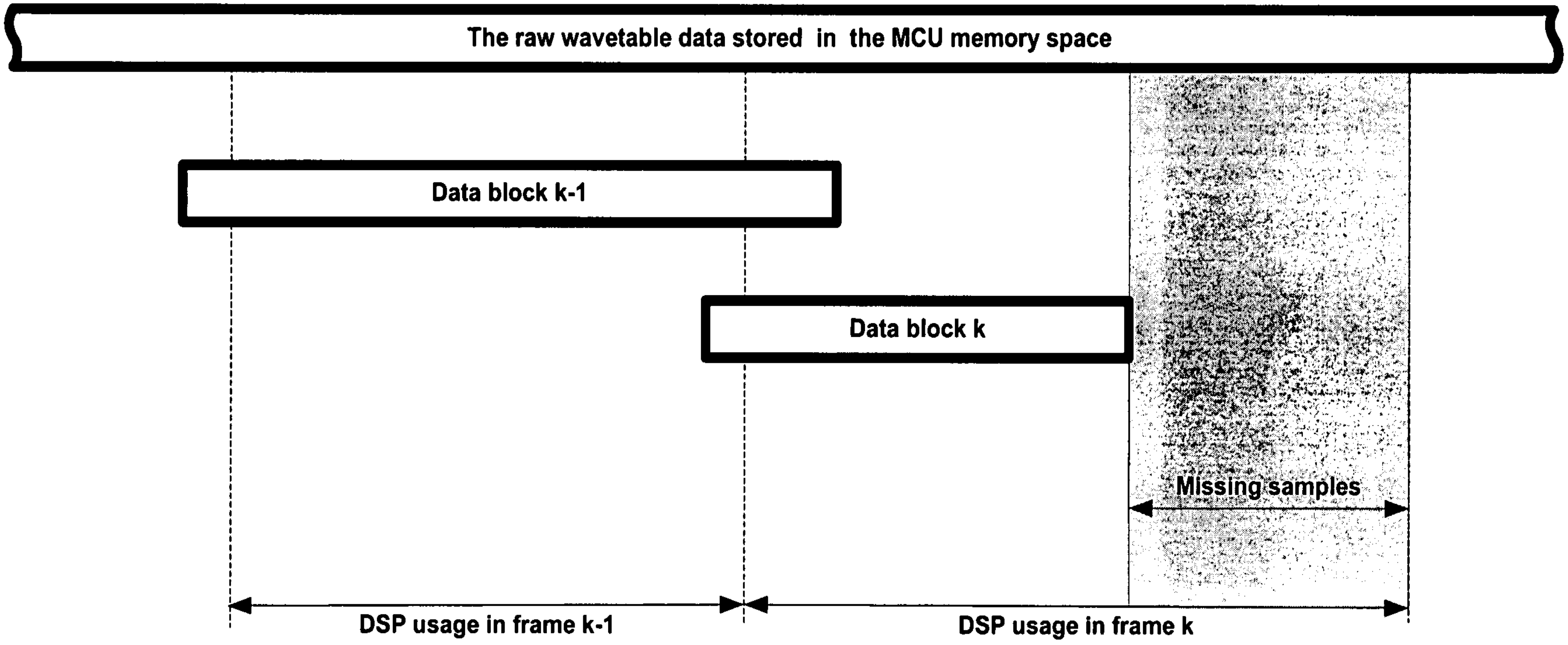

The raw wavetable data stored in the MCU memory space
Data block k-1
Data block k
Missing samples
DSP usage in frame k-1
DSP usage in frame k

Fig. 8